Ch 12 Mol Comp of Gases

Ch 11 in New

Volumes taken by gases → reveals info about other props of gases

Dalton

Measuring + Comparing Vol of Reactive Gases

HMWK on Pg 3

Gay-Lussac

Saw

$2L \text{ of } H_2 + 1L\ O_2 \rightarrow 2L\ H_2O$

2 volumes + 1 volume → 2 volumes

Were correct

Dalton → Atoms NOT destroyed

but did not know H_2 (atoms say indivisible)

Also Saw

H_2	+	Cl_2	→	HCl
1L		1L		2L
1 vol		1 vol		2 vol

Gay-Lussac's Law of Combing Vol – @ Const T + P the V of gas reactants Can be expressed as ratios of small whol #'s

Avogadro stepped in Said → equal Vol of gas @ same P+T have = # of molecules

↳ rejected Dalton by saying elements are diatomic

Makes sense $H_2 + Cl_2 \rightarrow 2HCl$

1 molecul 1 mole 2 molec.

1 mol of a gas has 6×10^{23} atoms or molecules

According to Avogadro's Principle - = Vol have same # of molecules

Therefore 1 mol of any gas has same volume.

↳ This volume @ STP = 22.4 L

easier to measure mol of gas by Vol than mass

So $\frac{1 \text{ mol}}{22.4 \text{ L}}$ is a conversion factor convert to mol ~~mass~~ from vol mass out.

Example → p 346, 347

Gas Density → Varies w/ T + P why B/C V changes

↳ Temp must be stated.

$$D_{STP} = \frac{\text{molar mass}}{\text{molar volume}} = \frac{g/mol}{22.4 L/mol} = \frac{g}{mol} \times \frac{mol}{22.4 L} = \frac{g}{22.4 L}$$

Q 348

Molar Mass @ STP from V

$D_{STP} = \frac{\text{molar mass}}{\text{molar Vol}} \rightarrow$ molar mass $= D_{STP} \times$ mol Vol

$\frac{g}{L} \times \frac{22.4\,L}{mol}$

Do prob 348-349

IDEAL GAS Eqn $PV = nRT \rightarrow$

Boyle's Law $V \propto \frac{1}{P}$,

Charles' $V \propto T$

Gaylus ~~$P \propto T$~~

Avogadro $V \propto n$

$V \propto \frac{1}{P} \times T \times n$

Related by a const R or K

$PV = nRT$

$R = 0.0082 \frac{L \cdot atm}{mol\ K}$

To Use this Eqn V in L, P in atm, T in K

all prop ↑

$\frac{PV}{RT} = R$ a const!

Ch 12 Q's p 350 q 6, 7

p 355 q 1, 3

p 360 q 1, 2, 3, 4 H p364 Q3

p 366 q 1, 5, 7

p 367 Q 10, 11, 17, 20,

p 368 Q 31, ~~App Prob~~

pg 369 App Prob Q22

Prob

Hand Q 10, 11, 12 p 367

18, 19 22

p 364 35, 37

Q 40, p 364

Using Ideal gas Law

$PV = nRT$ → can solve for any variable P V n T

↳ make sure $V = L$, $T = K$, $P = atm$ b/c $R = 0.082 \frac{L \cdot atm}{mol\ K}$

Examples pg 352-353

Finding molar mass by ideal gas Law

$mol = \frac{\text{mass}}{\text{molar mass}} \quad \frac{m}{M}$

$n = \frac{m}{M}$ → substitute → $PV = \frac{mRT}{M}$

$$\boxed{M = \frac{mRT}{PV}}$$

$Density = \frac{m}{V}$ → $M = \frac{DRT}{P}$ $\quad D = \frac{MP}{RT}$

Examples p 355

Stoichiometry of Gases

Thanks to Gay-Lussac + Avogadro

$$2CO + O_2 \longrightarrow 2CO_2$$

2 molecule	1 molec	2 molec
2 mol	1 mol	2 mol
2V	1V	2V

Ratio examples

$\frac{2\ vol\ CO}{1\ Vol\ O_2}$ etc

Vol-Vol Stoic

If 4 L of CO are used how much O_2 needed?

$$4\ L\ CO \times \frac{1\ vol\ O_2}{2\ vol\ CO_2} = 2\ L\ O_2$$

Not cut and dry mass → Vol

Vol → mass

process gas Vol A → mol A → mol B → mass B

mass A → mol A → mol B → Vol B

@STP $\frac{22.4\ L}{1\ mol}$ or use Ideal@ Non Standard

$PV = nRT$

Sample problem 359